Manchester encoding

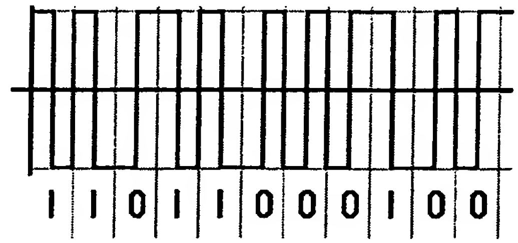
A form of encoding where a logical zero is coded as a change from one line state another, while a logical 'one' is coded as a change in the opposite direction. Manchester encoding is widely used in communications, for example in the ethernet system.

See also: encoding, ethernet

Kevin's computing glossary index

Manchester code

(Redirected from Manchester encoding)



Encoding of 11011000100 in Manchester code

In telecommunication, **Manchester code** is a form of data communication in which each bit of data is signified by at least one transition. Manchester encoding is therefore considered to be self-clocking, which means that accurate synchronisation of a data stream is possible. Each bit is transmitted over a predefined time period.

There are two opposing conventions for the representations of data.

The first of these was first published by G. E. Thomas in 1949 and is followed by numerous authors (e.g., Tannenbaum). It specifies that for a 0 bit the signal levels will be Low-High (assuming an amplitude physical encoding of the data) - with a low level in the first half of the bit period, and a high level in the second half. For a 1 bit the signal levels will be High-Low.

The second convention is also followed by numerous authors (e.g., Stallings) as well as by the IEEE 802.4 standard. It states that a logic 0 is represented by a High-Low signal sequence and a logic 1 is represented by a Low-High signal sequence.

A consequence of the transitions for each bit is that the bandwidth requirements for Manchester encoded signals is doubled compared with asynchronous communications, and the signal spectrum is considerably wider. Although Manchester encoding is a highly reliable form of communication, the bandwidth requirements are seen as a disadvantage, and most modern communication takes place with asynchronous communications protocols.

One consideration with Manchester encoding is synchronising the receiver with the transmitter. At first sight it might seem that a half bit period error would lead to an inverted output at the receiver end, but further consideration reveals that on typical data this will lead to code violations. The hardware used can detect these code violations, and use this information to synchronise accurately on the correct interpretation of the data.

A related technique is differential Manchester encoding.

In summary:

- data and clock signals are combined to form a single self-synchronizing data stream
- each encoded bit contains a transition at the midpoint of a bit period
- the direction of transition determines whether the bit is a "0" or a "1," and
- the first half is the true bit value and the second half is the complement of the true bit value. *Contrast with* **non-return-to-zero.**

Some source: from Federal Standard 1037C in support of MIL-STD-188

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Manchester encoding

<*communications*, *protocol*> A method of transmitting bits which enables the receiver to easily synchronise with the sender.

A simple way of signalling bits might be to transmit a high voltage for some period for a 1-bit and a low voltage for a 0 bit:

```
Bits Sent:              1     1     0     0

Signal:      High    ___________
             Low                |___________

Time: ->             .     .     .     .     .
```

However, when several identical bits are sent in succession, this provides no information to the receiver about when each bit starts and stops.

Manchester encoding splits each bit period into two, and ensures that there is always a transition between the signal levels in the middle of each bit. This allows the receiver to synchronise with the sender.

In normal Manchester encoding, a 1-bit is transmitted with a high voltage in the first period, and a low voltage in the second, and vice verse for the 0 bit:

```
Bits Sent:              1     1     0     0

Signal:      High    __    __        __    __
             Low       |__|  |______|  |__|

Time: ->             .  '  .  '  .  '  .  '  .
```

In Differential Manchester encoding, a 1-bit is indicated by making the first half of the signal equal to the last half of the previous bit's signal and a 0-bit is indicated by making the first half of the signal opposite to the last half of the previous bit's signal. That is, a zero bit is indicated by a transition at the beginning of the bit.

Like normal Manchester encoding, there is always a transition in the middle of the transmission of the bit.

```
       Differential Manchester Encoding

Bits Sent:              1     1     0     0

Signal:      High    ____      __    __    __
             Low         |____|  |__|  |__|
```

```
Time: ->                    . ' . ' . ' . ' .
```

With each bit period half as long, twice as much bandwidth is required when using either of the Manchester encoding schemes.

(1995-11-23)

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